Analysis of Potential Compliance Costs Associated with Proposed Nutrient Criteria for Montana Waters: Industrial Dischargers

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1. Introduction

The Montana Department of Environmental Quality (DEQ) is developing numeric nutrient criteria for nitrogen and phosphorus for waters in the state. Among the concerns from stakeholders involved in this process are the potential costs that may be associated with state implementation of the criteria in National Pollutant Discharge Elimination System (NPDES) permits. The U.S. Environmental Protection Agency (EPA) and EPA Region 8 are evaluating these concerns through analysis of potential compliance costs for an initial set of 12 industrial dischargers. This document describes the proposed criteria, available data, method, and results for these facilities.

1.1 Background

Exhibit 1 provides the draft criteria for total nitrogen (TN), total phosphorus (TP), and benthic algae in wadeable streams developed by Montana DEQ. No numeric nutrient criteria apply outside the applicable period shown in the exhibit.

Exhibit 1: Draft Nutrient Criteria

Level III Ecoregion	Applicable Period	Parameter		
		TP (mg/L)	TN (mg/L)	Benthic Algae
Northern Rockies	July 1 - Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Canadian Rockies	July 1 - Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Middle Rockies	July 1 - Sept. 30	0.03	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Idaho Batholith	July 1 - Sept. 30	0.03	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Northwestern Glaciated Plains*	June 16 - Sept. 30	0.12	1.1	na
Northwestern Great Plains*, Wyoming Basin*	July 1 - Sept. 30	0.12	1.2	na
Yellowstone River (Bighorn R. confluence to Powder R. confluence)	Aug 1 – Oct 31	0.09	0.8	Concentrations based on limiting pH impacts
Yellowstone River (Powder R. confluence to stateline)	Aug 1 – Oct 31	0.14	1.2	Concentrations based on limiting nuisance algal growth
na = not applicable TN = total nitrogen TP = total phosphorus				

Water quality criteria apply to surface waters, and do not represent any requirements for point sources or nonpoint sources. In implementing the proposed criteria in National Pollutant Discharge Elimination System (NPDES) permits, DEQ may revise effluent limits for municipal and industrial wastewater dischargers. DEQ may also allocate nutrient loadings and reductions through development of total maximum daily loads (TMDLs).

1.2 Purpose and Scope of the Analysis

The purpose of this analysis is to provide information on the potential for numeric nutrient criteria for nitrogen and phosphorus to result in incremental compliance costs for an initial set of 12 industrial dischargers. EPA Region 8 selected the 12 dischargers to be representative of major industrial dischargers and industrial categories. For this analysis, EPA did not evaluate compliance with the benthic algae criteria due to data limitations. In addition, further analysis would be required to evaluate the potential for compliance costs associated with the draft numeric nutrient criteria among the remaining industrial dischargers in the state.

1.3 Organization of the Report

Section 2 of the report discusses the data that are used in calculation of compliance costs to dischargers. Section 3 discusses the methods used in these analyses. Section 4 presents the results of the analyses, by discharger. Finally, Section 5 lists the references used in this report.

2. Data

This section describes the data sources we used to estimate potential compliance costs for the 12 dischargers. Exhibit 2 presents a summary of the industrial dischargers included in the analysis.

Exhibit 2: Industrial Dischargers in the Analysis

NPDES No.	Name	Major/Minor	SIC Code (Description)
MT0000248	Sidney Sugars Incorporated	Major	2063 (Beet Sugar)
MT0000264	Cenex Harvest States Cooperatives	Major	2911 (Petroleum Refining)
MT0000256	ConocoPhillips -- Billings Refinery	Major	2911 (Petroleum Refining)
MT0000485	Holcim (US) -- Trident Plant	Minor	3241 (Cement, Hydraulic)
MT0030350	REC Advanced Silicon Materials LLC	Minor	3339 (Primary Smelting and Refining of Nonferrous Metals, Except Copper and Aluminum)
MT0000477	ExxonMobil Refining and Supply	Major	2911 (Petroleum Refining)
MT0000396	Corette Thermal Plant	Major	4911 (Electric Services)
MT0023965	Western Energy Company -- Rosebud Mine	Major	1221 (Bituminous Coal and Lignite Surface Mining)
MT0000281	Western Sugar Cooperative	Major	2063 (Beet Sugar)
MT0030724	Fidelity -- Tongue River Project WTF	Minor	1311 (Crude Petroleum and Natural Gas)
MT0024716	Stillwater Mining Company	Minor	1021 (Copper Ores)
MT0000302	Montana Dakota Utilities, Lewis and Clark Station	Major	4911 (Electric Services)
gpd = gallons per day mgd = million gallons per day WTF = waste treatment facility			

For each facility, we obtained effluent nutrient concentration and flow rate data for the past three years from the Integrated Compliance Information System-National Pollutant Discharge Elimination System (ICIS-NPDES) database (EPA, 2011). For the facilities that do not report their effluent data to EPA, we examined the facility's permits and the accompanying factsheets or statement of basis for appropriate data to describe the effluent characteristics.

We determined the existing effluent limits from existing permits. We determined the design flow from the permits, fact sheets, or statement of basis. When the design flow was not available, we used the maximum observed flow rate to approximate the design flow.

Section 4 provides a summary of the relevant data for each discharger.

3. Method for Estimating Incremental Compliance Costs

In this section, we present the methods for estimating potential compliance costs, including determining reasonable potential to exceed water quality standards (WQS), projecting revised effluent limits, identifying potential needed controls, and estimating control costs based on unit costs and flow.

3.1 Determining Reasonable Potential

U.S. EPA (1991) indicates that any discharger with reasonable potential to cause or contribute to an exceedance of WQS would receive an effluent limit in its NPDES permit. For this analysis, we estimated reasonable potential for each of the 12 dischargers based on available data. If dilution is likely to be available in the receiving water (i.e., assimilative capacity exists in the receiving water), we used the following equation to determine the concentration of total nitrogen (TN) or total phosphorus (TP) at the edge of the mixing zone:

where,

C_{MZ}= Concentration of the pollutant at the edge of the mixing zone

C_b = Ambient background concentration (average of August concentrations)

$C_{e,max}$= Maximum observed effluent concentration for the applicable period (based on last 3 years of data)

Q_b = Ambient flow, 14Q10 (14-day low flow with a 10 year return frequency)

Q_e = Effluent flow rate (design flow).

A discharger has reasonable potential to cause or contribute to a WQS exceedance when the concentration at the edge of the mixing zone is greater than the applicable criterion.

If dilution is not available (i.e., no assimilative capacity exists in the receiving water), a discharger has reasonable potential when the maximum observed effluent concentration of the pollutant (based on the last three years of data) is greater than the applicable criterion (i.e., criteria end-of-pipe).

For dischargers for which no effluent nutrient data are available, we used other information regarding the potential for nutrients in waste streams from the relevant industrial processes to determine reasonable potential. This assumption could result in an overestimate of reasonable potential, noncompliance, and resulting costs.

3.2 Projecting Effluent Limits

For dischargers that would not have reasonable potential to exceed the applicable WQS, we assumed that they would not receive a revised effluent limit, and thus, would not incur incremental compliance costs under the proposed nutrient criteria.

For dischargers likely to have reasonable potential, we estimated projected average monthly effluent limits. We estimated likely dilution based on data from fact sheets and the receiving waters existing impairment status (e.g., we assumed there would be no dilution for any water on the state 303(d) list as impaired for nutrients due to a lack of assimilative capacity). Where no dilution is available, we assumed that the average monthly effluent limit would be equal to the criterion. In cases in which dilution is available, we used the following equation to estimate the average monthly effluent limit:

where,

AMEL = Average monthly effluent limit (mg/L)

WQC = Water quality criterion (mg/L)

C_b = Ambient background concentration (average of August concentrations; mg/L)

Q_b = Ambient flow, 14Q10 (14-day low flow with a 10 year return frequency; mgd)

Q_e = Effluent flow rate (design flow; mgd).

3.3 Identifying Controls and Costs

To determine whether incremental controls would be needed to comply with projected effluent limits, we compared available effluent data from the last three years to the projected average monthly effluent limit. If the available data indicate that the discharger would not be likely to exceed the projected limit (e.g., no exceedances of the projected limit; only a single outlier exceeding the projected limit), we assumed that there would not be incremental compliance costs. However, if effluent data suggest that the discharger would not be able to meet the projected limit, we assumed that compliance actions and associated costs would be likely.

We determined the necessary controls based on the projected effluent limits and the magnitude of reductions potentially needed, and used average unit costs for such controls to estimate incremental compliance costs. Because the criteria are seasonal, dischargers may consider temporary no-discharge control options such as land application and holding ponds. However, in highly populated areas or for dischargers with larger flows, no-discharge options may not be feasible or cost-effective. End-of-pipe treatment controls such as biological nutrient removal (BNR), chemical precipitation, microfiltration, and reverse osmosis may be necessary.

3.3.1 No-Discharge Controls

For this analysis, we based no-discharge control costs on constructing an in-ground holding pond to prevent discharge during the criteria period based on the design flow, and assuming that the discharger would gradually empty the pond during the months in which the nutrient limits would not apply. Costs for an in-ground holding pond primarily include site clearing, excavation, hauling, pond liner, and associated piping. We used unit costs from RSMeans (2007) which include overhead and profit, and escalated to 2010 dollars using the Construction Cost Index (CCI; ENR, 2011). **Exhibit** 3 shows the estimated unit costs for a holding pond.

Exhibit 3: Unit Capital Costs for Holding Ponds

Component	Capital Unit Cost (2010$)	Description
Site Clearing	\$398/acre	Selective clearing, brush mowing, tractor w/ rotary mower, no removal, light density

Excavation	\$4.15/bank cubic yard (BCY)	Excavation, Bulk, Scrapers, Towed 15 cubic yards, 1/4 push dozer, common earth, 1500' haul
Hauling	\$8.73/loose cubic yard (LCY)[1]	Hauling, excavated or borrow, loose cubic yards, no loading included, highway haulers, 20 cubic yards dump drailer, 10 mile round trip, 0.75 load/hr
Pond Liner	\$1.71/square foot	Reservoir Liners, 60 millimeter thick
Source: RSMeans (2007); escalated to 2010 dollars using the Construction Cost Index (CCI; ENR, 2011) 1. 1 LCY = 1.2 BCY.		

For this analysis, we assumed a pond depth of eight feet, and assumed that the design flow would need to be stored during the applicable criteria period. We assumed operations and maintenance (O&M) costs would be negligible. Finally, we estimated annual costs by annualizing capital costs at 7% over 10 years.[1]

3.3.2 End-of-Pipe Treatment

Traditional end-of-pipe treatment controls for removing nutrients from wastewater include biological and chemical processes. Biological nutrient removal (BNR) removes TN and TP from wastewater through the use of microorganisms under different environmental conditions in the treatment process (Metcalf and Eddy, 2003). Chemical precipitation with aluminum and iron coagulants or lime, removes TP by forming chemical flocs, which are then separated via clarification or filtration. Exhibit 5 summarizes potential end-of-pipe treatment controls and unit costs for different treatment levels based on U.S. EPA (2008).

Exhibit 4: End-of-Pipe Treatment Technologies to Remove Nutrients

Nutrient Treatment Level	Potentially Applicable Treatment Technologies	Unit Cost (2010\$)	
		Capital (\$/gpd)	O&M (\$/MG)
TN ≤ 3 mg/L	BNR[1]	\$1.04	\$105
TP ≤ 0.1 mg/L	Chemical treatment[2]	\$0.72	\$256
TN ≤ 3 mg/L and TP ≤ 0.1 mg/L	BNR with chemical treatment[3]	\$1.37	\$405

Source: U.S. EPA (2008).
gpd = gallons per day
MG = million gallons
O&M = operation and maintenance
TN = total nitrogen
TP = total phosphorus
1. Includes phased oxidation ditch; MLE (Modified Ludzack Ettinger); step-feed; denitrification filter; 4-stage Bardenpho; 5-stage Bardenpho with denitrification filter.
2. Includes fermenter, sand filtration, and 1-pt chemical addition; 2-pt chemical addition and filter; A/O (anaerobic/oxic) with fermenter, filter, and chemical addition.
3. Includes phased isolation ditch with chemical addition, clarifier, and filter; 5-stage Bardenpho and chemical addition with or without filter; nitrification, chemical addition, and denitrification filter.

However, these traditional biological and chemical wastewater treatment technologies are not effective for removing the dissolved fractions of organic nitrogen and phosphorus, which may be present in concentrations greater than the draft numeric nutrient criteria. For example, Bratby et al. (2008; as cited in Merlo et al., 2011) presented the results of a survey of secondary sewage effluent dissolved organic nitrogen that showed values ranging from 0.4 mg/L to 2.2 mg/L and an average value of 1.18 mg/L. Thus,

[1] The 10 year period is for consistency with the procedures in EPA's 1995 Interim Economic Guidance for Water Quality Standards, and may result in an over estimate of annual costs.

to achieve extremely low TN and TP effluent concentrations (as low as 0.3 mg/L TN and 0.025 mg/L TP), alternative technologies that target the dissolved organic fraction may be needed in addition to traditional biological and chemical treatment technologies.

One such technology is reverse osmosis (RO). RO uses a porous membrane and high pressure to separate water from undesired components (e.g., dissolved and ionic nitrogen or phosphorus). According to Ahn et al. (2002), RO effectively removes dissolved non-biodegradable organic matter (including dissolved organic nitrogen).

In practice, RO is typically preceded by microfiltration (MF), ultrafiltration, or nanofiltration to increase pollutant removals and reduce the likelihood of fouling the RO membranes. Studies of RO pilot- and full-scale systems (which may or may not include filtration pretreatment) indicate that TN removal efficiencies may range from 74% to 91% (Merlo, 2011). The lowest average RO effluent TN concentration from the studies is 1.0 mg/L, and all studies achieved TN effluent concentrations of less than 2 mg/L. Thus, depending on the influent concentrations to the RO system, a discharger could need to operate multiple RO units in series to achieve certain effluent limits.

Exhibit 5 shows estimated capital and O&M unit costs for RO with MF pretreatment based on estimates from Falk et al. (2011) and Tetra Tech (2011).

Exhibit 5: Summary of Potential End-of-Pipe Treatment Technologies

Nutrient Treatment Level	Treatment Technologies	Unit Cost (2010 $)	
		Capital ($/gpd)[1]	O&M ($/MG)[1]
TN ≤ 1 mg/L and TP ≤ 0.01 mg/L	Full stream MF and RO	$13	$980

Source: Falk et al. (2011) and Tetra Tech (2011)
gpd = gallons per day
MF = microfiltration
MG = million gallons
O&M = operation and maintenance
RO = reverse osmosis
TN = total nitrogen
TP = total phosphorus
1. Represents the difference between capital and O&M unit costs for a treatment train consisting of 5-stage Bardenpho process with chemical addition, high rate clarification, media filtration, MF, and RO and a treatment train consisting of 5-stage Bardenpho with chemical addition, high rate clarification, and media filtration (to account for only the MF and RO components of the treatment system).

To estimate capital costs, we multiplied the applicable unit costs by the design flow for the discharger. For dischargers for which design flow is not available, we used the maximum observed flow rate to estimate the design flow. For O&M costs, we used the average flow and number of days the discharger would need to operate the treatment controls (i.e., applicable criteria period). We estimated annual costs by annualizing capital costs at 7% over 10 years (see footnote 1 above), and adding annual O&M to the annualized capital cost.

4. Results

The sections below present the results of the analyses for each discharger.

4.1 Sidney Sugars Incorporated

Sidney Sugars Incorporated (NPDES No. MT 0000248) processes sugar beets to produce refined sugar and additional byproducts including beet pulp, molasses, pellets, calcium carbonate and slaked lime. The facility processes sugar beets seasonally during periods called campaigns, typically lasting from September through February or March (MTDEQ, 2009a). The discharger reported that it slices 6,200 tons of beets per day, and manufactures 1,822,800 lb of sugar per day (MTDEQ, 2009a).

The facility treats process and flume wastewater using an aeration pond, a clarifier, and various site impoundments that include a 100-acre impoundment (Section 25 pond) and other process ponds. None of these ponds are lined and the wastewater infiltrates the local groundwater.

The four outfalls include:

- Outfall 001: discharge from the Section 25 pond to the Yellowstone River via direct discharge
- Outfall 002: discharge from the Section 25 pond to the Yellowstone River via groundwater infiltration (Section 25 pond is approximately 150 feet from Yellowstone River and is hydraulically connected)
- Outfall 003: discharge from the Process Ponds to Class II ground water via groundwater infiltration (no connectivity to Yellowstone River)
- Outfall LA-1: discharge from the Section 25 pond to surface land application (from March 1st through October 31st).

For this analysis, we only consider discharges that affect surface waters (i.e., Outfall 001 and 002).

During the 2006 – 2007 campaign, the average monthly discharge to the Section 25 pond was 1.01 mgd and the maximum monthly discharge average was 1.3 mgd (MTDEQ, 2009a).

4.1.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 1.2 mg/L and 0.14 mg/L, respectively, and are applicable only during the months of August through October. Exhibit 6 summarizes the nutrient data including TN and TP for Outfall 002. Note that there are no discharges from Outfall 001 during the period in which the nutrient criteria apply.

Exhibit 6: Effluent Data Summary, Sidney Sugars Incorporated

Pollutant	Number of Observations	Average Effluent Concentration (mg/L)	Maximum Effluent Concentration (mg/L)	Effluent Limit (mg/L)
		Outfall 002		
TKN[1]	20	16.0	30.3	None
TN[2]	20	16.5	30.8	None
TP[3]	1	0.54	0.54	None

na = not available
1. From MDEQ fact sheet. (MTDEQ, 2009a)
2. TN represents reported TKN plus maximum reported nitrate/nitrate concentration (0.5 mg/L; MTDEQ, 2009a).
3. Represents a single observation for wastewater used for land application (LA-1) from MDEQ fact sheet. (MTDEQ, 2009a)

4.1.2 Estimated Compliance and Costs

Discharge from Outfall 001 is rare. Available data indicate that there have been three discharges from Outfall 001 since 1986: discharges in 1986, 1991, and 2011. Thus, because it is highly uncertain whether a discharge would occur during the applicable criteria months, we assumed that it is unlikely that the facility would install treatment controls to reduce nutrients from this direct discharge.

For Outfall 002, the discharger's fact sheet indicates that the facility must conduct a mixing zone study to assess the impact of the infiltration from the outfall pond through groundwater on the Yellowstone River (MTDEQ, 2009a). However, the existing permit does not allow for dilution in the calculation of effluent limits. In addition, the Yellowstone River (MT42M001_011) is on the state's 2010 303(d) list as impaired for nutrients. Consequently, for this analysis, we assume that the facility would not receive dilution for Outfall 002.

Exhibit 7 shows the reasonable potential analysis and projected effluent limits for TN and TP.

Exhibit 7: Reasonable Potential Analysis, Sidney Sugars Incorporated

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)
Outfall 002				
TN[1]	30.8	1.2	Yes	1.2
TP[2]	0.54	0.14	Yes	0.14
1. Calculated as reported TKN (30.3 mg/L) plus maximum reported nitrate/nitrate concentration (0.5 mg/L; MTDEQ, 2009a).				
3. Represents a single observation for wastewater used for land application (LA-1) from MDEQ fact sheet. (MTDEQ, 2009a)				

The exhibit indicates that the maximum TN and TP concentrations for Outfall 002 exceed the proposed criteria, and that controls are likely necessary for compliance with projected effluent limits based on the proposed criteria. Because the discharge to the receiving water is continuous through groundwater infiltration from a 100-acre settling pond (as indicated in the fact sheet) and it is not clear how long it takes the wastewater entering the pond to infiltrate the groundwater and seep into the adjacent receiving water, we assumed that all wastewater sent to the settling pond would need to be treated to meet the projected effluent limits. Based on existing TN and TP effluent concentrations, we estimated that the discharger would need to implement biological and chemical treatment controls to reduce TN and TP to 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 60% to less than 1.2 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 1.30 mgd into the Section 25 pond (information on design flow is not available), total capital costs could be approximately \$18.7 million. Based on an average flow of 1.01 mgd into the Section 25 pond and assuming operation of the treatment units for 212 days during the campaign period (because wastewater seeps into groundwater on a constant basis, not just during the criteria period), annual O&M costs could be approximately \$0.03 million. Total annual costs would be \$3.0 million based on annualizing capital costs at 7% over 10 years plus annual O&M. Exhibit 8 summarizes these costs.

Exhibit 8: Potential Incremental Costs, Sidney Sugars Incorporated

Treatment Controls	Capital Costs (\$ million)[1]	O&M Cost (\$ million/year)[2]	Annual Costs (\$ million/year)[3]
Biological and Chemical Treatment plus RO with MF	\$18.7	\$0.30	\$3.0

1. Maximum flow (1.30 mgd; design flow not available) multiplied by unit cost of \$14.37/gpd for biological and chemical treatment plus RO with MF.
2. Average flow (1.01 mgd) multiplied by unit cost of \$1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (212 days).
3. Capital costs annualized at 7% over 10 years plus annual O&M.

4.2 Cenex Harvest States Cooperatives

Cenex Harvest States Cooperatives (NPDES No. MT 0000264) is a petroleum refinery that processes crude oil into higher value petroleum products. The refinery contains distillation, desulfurization, catalytic cracking, catalytic reforming, hydrotreating, and alkylation units. The average refinery feedstock rate is 45,500 barrels per day (MTDEQ, 1994).

The refinery wastewater treatment system consists of three Pielkenrood separators, two API oil-water separators, a dissolved air floatation unit, an aerated sludge digester and clarifier, a sludge retention pond, two aerated retention ponds, and a number of surge tanks and intermediate vessels. The refinery diverts both process water and cooling water from the Yellowstone River. The City of Laurel, MT supplies domestic water for the refinery which discharges all domestic wastewater to the Laurel sanitary sewer system.

The facility treats process wastewater, cooling tower blowdown, and storm water runoff prior to discharging approximately 2.2 mgd (based on maximum observed flow rates) of treated effluent through Outfall 001 to the Yellowstone River.

4.2.1 Summary of Effluent Data and Limits

The proposed criterion for TN is 0.4 mg/L and is applicable only during the months of August through October. Exhibit 9 summarizes the nutrient data including TN for these months. Data on nitrogen species in refinery wastewater indicate that ammonia may comprise between 59% and 90% of TN (Kenari, 2010; Knight, 1999; Zhidong, 2010). Thus, we calculated TN assuming that ammonia as nitrogen accounts for 59% of the TN in the effluent. TP data are not available for this facility.

Exhibit 9: Effluent Data Summary, Cenex Harvest States Coop

Pollutant	Number of Observations	Average Effluent Concentration (mg/L)[1]	Maximum Effluent Concentration (mg/L)[1]	Effluent Limit (mg/L)
Outfall 001				
NH_3 as N	9	4.1	21.1	None

TN[2]	na	7.0	35.8	None
na = not available 1. Nutrient effluent data from 2008 through 2010 from the months of August through October representing average and maximum of maximum monthly values. (EPA, 2011) 2. Calculated assuming that ammonia accounts for 59% of total nitrogen in the effluent.				

4.2.2 Estimated Compliance and Costs

The facility discharges into Yellowstone River (MT43F001_011), which is on the state's 2010 303(d) list as impaired for nitrate/nitrite but not ammonia or TN. The current permit allows for a mixing zone. However, given the existing impairment, it is unclear if the facility would receive a mixing zone and therefore, we consider the following two scenarios:

- Scenario 1: the discharger receives a mixing zone, and
- Scenario 2: the discharger does not receive a mixing zone.

Exhibit 10 shows the reasonable potential analysis and projected effluent limits for TN under both scenarios.

Exhibit 10: Effluent Limit and Reasonable Potential Analysis, Cenex Harvest States Coop

Pollutant	Effluent Data		Receiving Water Data			Calculations		
	Max. Effluent Concen-tration (mg/L)[1]	Design Flow (mgd)	Ambient Concen-tration (mg/L)	14Q10 (mgd)	Proposed Criterion (mg/L)	Concen-tration at Edge of Mixing Zone (mg/L)	Reasonable Potential[2]	Projected Effluent Limit (mg/L)
Scenario 1: Mixing Zone Allowed								
TN	35.8	2.2	0.32	1,194	0.4	0.38[3]	No	46.6[4]
Scenario 2: No Mixing Zone								
TN	35.8	na	na	na	0.4	35.8[5]	Yes	0.4[6]

na = not available
1. Calculated assuming that ammonia accounts for 59% of total nitrogen in the effluent.
2. Reasonable potential exists if concentration at edge of mixing zone exceeds proposed criterion.
3. Calculated using mixing equation, ambient TN concentration, and assumption that 100% of 14Q10 is available for dilution using and 14Q10.
4. Calculated based on simple mixing equation using proposed criterion and 14Q10.
5. Represents maximum effluent concentration because no mixing zone is available.
6. The projected effluent limited is equal to the proposed criterion

The exhibit indicates that under Scenario 1, the facility would not have reasonable potential and would not likely receive an effluent limit for TN (assuming full dilution with the 14Q10 receiving water flow is available). There would be no costs under this scenario.

Under Scenario 2, the facility would have reasonable potential to exceed the proposed criteria, and controls would likely be necessary for compliance with the projected effluent limit based on the proposed criterion. While TP data are not available to determine reasonable potential, we conservatively (i.e., to err on the side of higher costs) assumed that the facility would also have reasonable potential to exceed the proposed criterion for TP and may need to reduce TP to comply with the projected effluent limit based on the proposed criterion. Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (200 million gallons requiring a pond size of almost 77 acres), existing effluent quality (may not be suitable for land application), and potential lack of available land may make no-discharge control options infeasible or unlikely. Thus, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 87% to less than 0.4 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 2.17 mgd (information on design flow is not available), total capital costs could be approximately $31.2 million. Based on an average flow of 1.19 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.15 million. Total annual costs would be $4.6 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 11 summarizes costs under both scenarios.

Exhibit 11: Potential Incremental Costs, Cenex Harvest States Coop

Treatment Control	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Scenario 1, Mixing Zone Granted			
None	$0.0	$0.0	$0.0
Scenario 2, No Mixing Zone			
Biological and Chemical Treatment plus RO with MF	$31.2[2]	$0.15[3]	$4.6

1. Capital costs annualized at 7% over 10 years plus annual O&M.
2. Maximum flow (2.17 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF.
3. Average flow (1.19 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).

4.3 ConocoPhillips – Billings Refinery

ConocoPhillips – Billings Refinery (NPDES No. MT 0000256) is a petroleum refinery that processes crude oil into higher value petroleum products. The facility contains fractionation, desulfurization, catalytic cracking, catalytic reforming, butane isomerization, alkylation and delayed coking units. The refinery is capable of refining 61,000 barrels per day of crude oil (MTDEQ, 2008).

The refinery wastewater treatment system consists of oil separation and biological treatment equipment. These units include cross plate separators, gravity separation, dissolved air flotation, activated sludge clarifier units, aeration and equalization tanks, clarifier, bio-oxidation ponds, and holding and emergency diversion ponds. After treatment, the water enters a series of three stabilization/polishing ponds prior to discharge.

The facility performs hydrostatic testing to test for leaks in cleaned tanks and pipelines with either treated refinery water or potable water from the City of Billings. The facility also collects groundwater from the site and processes the collected groundwater through the refinery wastewater treatment system. The average groundwater production rate is estimated to be 0.18 mgd.

Outfall 001 discharges a maximum of 1.74 mgd (based on maximum observed flow rate) of non-process wastewater, treated process wastewater, and stormwater to the Yegen Drain. Outfall 002 discharges hydrostatic testing water to the Yegen Drain. The facility discharges sanitary wastewater to the City of Billings wastewater collection system.

4.3.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 1.1 mg/L and 0.12 mg/L, respectively, and are applicable only during the months of June through September. Exhibit 12 summarizes the nutrient data including TN and TP for these months. Data on nitrogen species in refinery wastewater indicate that ammonia may comprise between 59% and 90% of TN (Kenari, 2010; Knight, 1999; Zhidong, 2010). Thus, we calculated TN assuming that ammonia as nitrogen accounts for 59% of the TN in the effluent.

Exhibit 12: Effluent Data Summary, ConocoPhillips – Billings Refinery

Pollutant	Number of Observations	Average Effluent Concentration (mg/L)	Maximum Effluent Concentration (mg/L)	Effluent Limit (mg/L)
Outfall 001				
NH_3 as N[1]	12	4.7	34.0	None
TN[2]	na	7.9	57.6	None
TP[3]	2	4.0	5.0	None
Outfall 002				
NH_3, as N[1]	2	13.1	26.0	None
TN[2]	na	22.1	44.1	None

na = not available
1. Nutrient effluent data from 2008 through 2010 from the months of June through September representing average and maximum of maximum monthly values. (EPA, 2011)
2. Calculated assuming that ammonia accounts for 59% of total nitrogen in the effluent
3. Measurements taken from the fact sheet. (MTDEQ, 2008)

4.3.2 Estimated Compliance and Costs

Outfalls 001 and 002 discharge to the Yegen Drain, a tributary to the Yellowstone River. The Yellowstone River (MT43F001_010) is on the state's 2010 303(d) list as impaired for nutrients/eutrophication biological indicators. In addition, the low flow in the Yegen Drain is 1 cfs, and the maximum measured background concentration of ammonia is 18.4 mg/L (MTDEQ, 2008).

Thus, despite the fact that the current permit allows for a mixing zone for ammonia, we estimated compliance and costs with the proposed TN and TP criteria based on the assumption that no dilution would be available given the existing impairment status of the downstream receiving water, high concentration of ammonia in the immediate receiving water, and low flow rate of the receiving water.

Exhibit 13 shows the reasonable potential analysis and projected effluent limits for TN and TP for Outfalls 001 and 002.

Exhibit 13: Reasonable Potential Analysis, ConocoPhillips – Billings Refinery

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)[1]
Outfall 001				
TN	57.6[2]	1.1	Yes	1.1
TP	5.0	0.12	Yes	0.12

Outfall 002				
TN	44.1[2]	1.1	Yes	1.1
1. The projected effluent limited is equal to the proposed criterion. 2. Calculated assuming that ammonia accounts for 59% of total nitrogen in the effluent.				

Based on the maximum effluent concentrations, the facility has reasonable potential for both TN and TP, and would therefore likely receive revised effluent limits for both pollutants. Effluent data for Outfall 001 indicate that controls are likely necessary for compliance with projected effluent limits based on the proposed criteria. For Outfall 002, effluent data indicate that reductions in TN may be needed for compliance with projected effluent limits based on the proposed criteria. However, Outfall 002 is an intermittent discharge for releasing hydrostatic test water which is made up of Outfall 001 effluent or potable water. Thus, since reducing nutrient concentrations in Outfall 001 would also result in reductions in Outfall 002 nutrient concentrations, we assumed that no incremental controls would be required for Outfall 002.

The current permit requires a compliance schedule for ammonia to meet existing effluent limits (due in March 2012). Although it is likely that some additional controls are necessary to reduce nutrient levels for compliance with baseline permit requirements, the extent or nature of such controls is unknown. Thus, this analysis likely overstates potential incremental costs because it does not factor in these necessary baseline controls.

Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (160 million gallons requiring a pond size of over 61 acres), existing effluent quality (may not be suitable for land application), and potential lack of available land may make no-discharge control options infeasible or unlikely. Thus, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 63% to less than 1.1 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 1.74 mgd (information on design flow is not available), total capital costs could be approximately $24.9 million. Based on an average flow of 0.476 mgd and assuming operation of the treatment units for 122 days during the criteria period, annual O&M costs could be approximately $0.080 million. Total annual costs would be $3.6 million based on annualizing capital costs at 7% over 10 years plus annual O&M. Exhibit 14 summarizes these costs.

Exhibit 14: Potential Incremental Costs, ConocoPhillips – Billings Refinery

Treatment Control	Capital Costs ($ million)[1]	O&M Cost ($ million/year)[2]	Annual Costs ($ million/year)[3]
Biological and Chemical Treatment plus RO with MF	$24.9	$0.08	$3.6
1. Maximum flow (1.74 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF. 2. Average flow (0.476 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (122 days). 3. Capital costs annualized at 7% over 10 years plus annual O&M.			

4.4 Holcim (US) - Trident Plant

Holcim (US) – Trident Plant (NPDES No. MT 0000485) manufactures cement from limestone and other raw materials including iron and gypsum. Three groundwater wells supply raw water to the plant, 90% of which is used as process water, cooling water, cleaning equipment, make-up water, and for watering roads, while the remaining 10% is disinfected for potable water use.

The Holcim wastewater treatment plant is a small extended aeration package plant consisting of a combined aeration tank and clarifier. The wastewater treatment plant treats sanitary waste and serves approximately 84 workers from the Holcim office building, the nearby Montana Rail Link depot, and one building from the old company town of Trident. Outfall 002 discharges to the Missouri River.

4.4.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 0.8 mg/L and 0.09 mg/L, respectively, and are applicable only during the months of August through October. Exhibit 15 summarizes the nutrient data including TN and TP for these months.

Exhibit 15: Effluent Data Summary, Holcim (US) – Trident Plant

Pollutant	Number of Observations	Average Effluent Concentration (mg/L) [1]	Maximum Effluent Concentration (mg/L) [1]	Effluent Limit (mg/L)
Outfall 002				
TN	9	7.7	14.7	None
TP	9	0.6	1.3	None
1. Effluent data from 2008 through 2010 from the months of August through October representing average and maximum of a combination of maximum monthly values reported between 2008 and 2009 for the months of August through October and average monthly values reported between August 2010 and October 2010. (EPA, 2011)				

4.4.2 Estimated Compliance and Costs

The facility discharges to the Missouri River (MT41I001_011) which is on the state's 2010 303(d) list as impaired for TN. The existing permit does not allow for a mixing zone. Thus, we assumed that no dilution would be available in the calculation of projected effluent limits. Exhibit 16 shows the reasonable potential analysis and projected effluent limits for TN and TP.

Exhibit 16: Reasonable Potential Analysis, Holcim (US) – Trident Plant

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)[1]
Outfall 002				
TN	14.7	0.8	Yes	0.8
TP	1.3	0.09	Yes	0.09
1. The projected effluent limited is equal to the proposed criterion.				

The exhibit indicates that the maximum TN and TP concentrations exceed the proposed criteria, and that controls are likely necessary for compliance with projected effluent limits based on the proposed criteria. Since the effluent flow rate is relatively small, it is possible that no-discharge control options are available, including constructing a holding pond to prevent release during the criteria period. However, because it is unclear if no-discharge controls would be feasible, we considered the following two scenarios for Outfall 001:

- Scenario 1: the discharger would implement no-discharge controls during the months of August through October, and
- Scenario 2: the discharger would implement end-of-pipe treatment.

Under Scenario 1, we estimated potential compliance costs assuming that the discharger would construct a holding pond to prevent discharge during the months of August through October. We estimated capital costs of approximately $109,000 based on the capital unit cost presented in Exhibit 3, a maximum discharge of 0.0113 mgd[2], and a period of 92 days during the criteria period. Total annual costs would be $16,000 based on annualizing capital costs at 7% over 10 years.

Under Scenario 2, we estimated potential compliance costs assuming that the discharger would implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 73% to less than 0.4 mg/L and TP by an additional 10% to 0.09 mg/L. We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 0.0113 mgd, total capital costs could be approximately $163,000. Based on an average flow of 0.0089 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $1,000. Total annual costs would be $24,000 based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 17 summarizes costs under both scenarios.

Exhibit 17: Potential Incremental Costs, Holcim (US) – Trident Plant

Treatment Control	Capital Costs	O&M Cost ($/year)	Annual Costs ($/year)[1]
Scenario 1: No-Discharge Control (Holding Pond)	$109,000[2]	$0[3]	$16,000
Scenario 2: End-of-Pipe Treatment (Biological and Chemical Treatment plus RO with MF)	$163,000[4]	$1,000[5]	$24,000

1. Capital costs annualized at 7% over 10 years plus annual O&M.
2. Based on maximum flow (0.0113 mgd; design flow may underestimate necessary pond size), 92 day criteria period, and unit costs in Exhibit 3.
3. O&M costs for no-discharge using a holding pond are expected to be negligible.
4. Maximum flow (0.0113 mgd) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF.
5. Average flow (0.0089 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).

[2] Since the existing design flow of 0.0072 mgd (MTDEQ, 2011) is exceeded by the average flow during the criteria period, the maximum observed flow was used to estimate capital costs.

4.5 REC Advanced Silicon Materials LLC

REC Advanced Silicon Materials LLC (NPDES No. MT 00030350) produces high purity polycrystalline silicon for the electronics industry by refining metallurgical grade silicon. The facility routes wastewater from the various process sections to an equalization basin. From the equalization basin, the wastewater receives physical treatment via flocculation, clarification, and neutralization. The facility mixes treated water with cooling tower blowdown water prior to discharge.

The discharger has three Outfalls:

- Outfall 001 discharges wastewater to Sheep Gulch (approximately 1.15 mgd maximum).
- Outfall 002 discharges storm water collected in detention ponds to Sheep Gulch.
- Outfall 003 is an alternate wastewater discharge location to Silver Bow Creek.

Neither Outfall 002 nor 003 have discharged over the life of the facility (MTDEQ, 2010b) and therefore, we considered only Outfall 001 for this analysis.

4.5.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 0.3 mg/L and 0.03 mg/L, respectively, and are applicable only during the months of July through September. Exhibit 18 summarizes the nutrient data including TN and TP for these months.

Exhibit 18: Effluent Data Summary, REC Advanced Silicon Materials LLC

Pollutant	Number of Observations	Average Effluent Concentration (mg/L) [1]	Maximum Effluent Concentration (mg/L) [1]	Effluent Limit (mg/L)
Outfall 001				
TN	3	1.2	2.6	2.4
TP	3	0.21	0.33	0.64
1. Effluent data represent average and maximum of maximum values from 2008 to 2010 from September (quarterly measurements; EPA, 2011)				

4.5.2 Estimated Compliance and Costs

Because no mixing zone is included in the existing permit, we assumed no dilution would be available for the calculation of projected effluent limits. Exhibit 19 shows the reasonable potential analysis and projected effluent limits for TN and TP.

Exhibit 19: Reasonable Potential Analysis, REC Advanced Silicon Materials LLC

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)[1]
Outfall 001				
TN	2.6	0.3	Yes	0.3
TP	0.33	0.03	Yes	0.03
1. The projected effluent limited is equal to the proposed criterion.				

The exhibit indicates that the maximum TN and TP concentrations exceed the proposed criteria, and that controls are likely necessary for compliance with projected effluent limits based on the proposed criteria.

Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (106 million gallons requiring a pond size of over 40 acres), existing effluent quality (may not be suitable for land application), and potential lack of available land may make no-discharge control options infeasible or unlikely.

We estimated potential compliance costs assuming that the discharger would need to implement chemical treatment to reduce TP to less than 0.1 mg/L and then add RO with MF to reduce TP by an additional 70% to less than 0.03 mg/L. The RO with MF would also reduce TN by an approximately 88% from current maximum concentrations to less than 0.3 mg/L.

We estimated capital and O&M costs of approximately $13.72/gpd ($0.72/gpd for chemical treatment plus $13.00/gpd for MF and RO) and $1,236/MG ($256/MG for chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 1.15 mgd (information on design flow is not available), total capital costs could be approximately $15.8 million. Based on an average flow of 0.780 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.089 million. Total annual costs would be $2.3 million based on annualizing capital costs at 7% over 10 years plus annual O&M. Exhibit 20 summarizes these costs.

Exhibit 20: Potential Incremental Costs, REC Advanced Silicon Materials LLC

Treatment Control	Capital Costs ($ million)[1]	O&M Cost ($ million/year)[2]	Annual Costs ($ million/year)[3]
Chemical Treatment plus RO with MF	$15.8	$0.089	$2.3

1. Maximum flow (1.15 mgd; design flow not available) multiplied by unit cost of $13.72/gpd for chemical treatment plus RO with MF.
2. Average flow (0.780 mgd) multiplied by unit cost of $1,236/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).
3. Capital costs annualized at 7% over 10 years plus annual O&M.

4.6 ExxonMobil Refining and Supply

ExxonMobil Refining and Supply, Billings Refinery (NPDES No. MT 0000477) is a petroleum refinery that processes crude oil into higher value petroleum products. In 1998, the refinery had a capacity of refining 60,500 barrels per day of crude oil (MTDEQ, 2007).

The facility's wastewater treatment consists of an API separator, induced air flotation unit, a biological oxidation lagoon, and stabilization/polishing ponds.

The facility discharges a maximum of 2.7 mgd (based on the maximum observed flow rate) of treated wastewater through Outfall 001 and once through, noncontact cooling water through Outfall 002 into the Yellowstone River.

4.6.1 Summary of Effluent Data and Limits

The proposed criterion for TN is 0.4 mg/L, and is applicable only during the months of August through October. Exhibit 21 summarizes the nutrient data for these months from Outfall 001. The permit does not contain monitoring requirements for nutrients for Outfall 002. Data on nitrogen species in refinery wastewater indicate that ammonia may comprise between 59% and 90% of TN (Kenari, 2010; Knight, 1999; Zhidong, 2010). Thus, for the reasonable potential and incremental control analyses for TN, we calculated TN assuming that ammonia as nitrogen accounts for 59% of the TN in the effluent. There are no TP data available for this facility.

Exhibit 21: Effluent Data Summary, ExxonMobil Refining and Supply

Pollutant	Number of Observations	Average Effluent Concentration (mg/L) [1]	Maximum Effluent Concentration (mg/L) [1]	Effluent Limit (mg/L)
Outfall 001				
NH_3 as N	9	11.9	21.8	None
TN	na	20.1[2]	36.9[2]	None
na = not available 1. Ammonia as nitrogen effluent data from 2008 through 2010 from the months of August through October representing average and maximum of maximum monthly values. (EPA, 2011) 2. Calculated assuming that ammonia accounts for 59% of total nitrogen in the effluent.				

4.6.2 Estimated Compliance and Costs

Outfalls 001 and 002 discharge into the Yellowstone River (MT43F001_010), which is on the state's 2010 303(d) list as impaired for nutrient/eutrophication biological indicators.[3] While the existing permit does allow for a mixing zone for ammonia, we conservatively (i.e., to err on the side of higher costs) assume that no dilution would be available for this analysis because the receiving water is impaired for the pollutants of concern (i.e., nutrients or TN and TP). Exhibit 22 shows the reasonable potential analysis and projected effluent limit for TN.

Exhibit 22: Reasonable Potential Analysis, ExxonMobil Refining and Supply

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)[1]
Outfall 001				
TN	36.9[2]	1.1	Yes	1.1
1. The projected effluent limited is equal to the proposed criterion and represents an average monthly limit. 2. The total nitrogen was calculated using the maximum ammonia as nitrogen effluent concentration during the criteria period of August through September (21.8 mg/L) and assuming that ammonia accounts for 59% of total nitrogen in the effluent.				

The exhibit indicates that the maximum TN concentrations exceed the proposed criteria, and that controls are likely necessary for compliance with projected effluent limit based on the proposed criterion. All of the effluent ammonia values exceed the projected average monthly TN effluent limit (hence, so would all of the TN concentrations because ammonia is a component of TN). Thus, the facility would likely need to install incremental treatment controls for compliance with projected effluent limits for TN. While TP data are not available to determine reasonable potential, we conservatively (i.e., to err on the side of higher costs) assumed that the facility would also have reasonable potential to exceed the proposed criteria for TP and may need to reduce TP to comply with projected effluent limits based on the proposed criterion.

[3] Note that the fact sheet indicates that the receiving waterbody segment is identified as MT43Q00_12 (MTDEQ, 2007). However, the latitude/longitude of the diffuser of Outfall 001 (45° 49' 21.053" N, 108 ° 25' 34.039" W) and EPA's MyWATERS Mapper (http://www.epa.gov/waters/mywatersmapper/index.html), indicate that the receiving waterbody ID is MT43F001_010.

Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (104 million gallons requiring a pond size of almost 40 acres), existing effluent quality (may not be suitable for land application), and potential lack of available land may make no-discharge control options infeasible or unlikely. Thus, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 63% to less than 1.1 mg/L.

We estimated capital and O&M costs of approximately \$14.37/gpd (\$1.37/gpd for biological and chemical treatment plus \$13.00/gpd for MF and RO) and \$1,385/MG (\$405/MG for biological and chemical treatment plus \$980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 2.7 mgd (information on design flow is not available), total capital costs could be approximately \$38.8 million. Based on an average flow of 1.13 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately \$0.144 million. Total annual costs would be \$5.7 million based on annualizing capital costs at 7% over 10 years plus annual O&M. Exhibit 23 summarizes these costs.

Exhibit 23: Potential Incremental Costs, ExxonMobil Refining and Supply

Treatment Control	Capital Costs (\$ million)[1]	O&M Cost (\$ million/year)[2]	Annual Costs (\$ million/year)[3]
Biological and Chemical Treatment plus RO with MF	\$38.8	\$0.144	\$5.7

1. Maximum flow (2.7 mgd; design flow not available) multiplied by unit cost of \$14.37/gpd for biological and chemical treatment plus RO with MF.
2. Average flow (1.13 mgd) multiplied by unit cost of \$1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).
3. Capital costs annualized at 7% over 10 years plus annual O&M.

4.7 Corette Thermal Plant

Corette Thermal Plant (NPDES No. MT 0000396) is a coal fired steam electric generating plant with two outfalls. Outfall 002 is once-through condenser cooling water (the facility does not add chemicals to the once-through cooling water). Outfall 003 discharges wastewater from the bottom ash handling system and miscellaneous low volume wastes including plant floor drains, furnace seal water evaporation blowdown, and storm water runoff. The facility does not treat the wastewater prior to discharge to the Yellowstone River.

4.7.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 0.4 mg/L and 0.09 mg/L, respectively, and are applicable only during the months of August through October. There are no effluent TN and TP data available in EPA's ICIS-NPDES database for this discharger. There are no effluent limits for TN or TP in the permit.

4.7.2 Estimated Compliance and Costs

The facility does not have existing effluent limits or monitoring requirements for TN or TP. The facility discharges once-through cooling water through Outfall 002. U.S. EPA (2009) indicates that once-through cooling water and cooling tower blowdown may contain the following pollutants, often in low concentrations, as a result of chlorination and corrosion and erosion of the piping, condenser, and cooling tower materials: chlorine, iron, copper, nickel, aluminum, boron, chlorinated organic compounds, suspended solids, brominated compounds, and nonoxidizing biocides. Thus, given the lack of existing permit requirements and the nature of the wastewater (e.g., once-through cooling water), it is unlikely that the facility would have reasonable potential to exceed the proposed criteria for TN and TP. Thus, incremental compliance costs are likely zero.

For Outfall 003, it is uncertain whether discharge of bottom ash handling system and miscellaneous wastes would contain nutrients. The Yellowstone River is on the state's 2010 303(d) list as impaired for nutrient/eutrophication biological indicators, and thus, it is unlikely the facility would receive a mixing zone in the calculation of potential revised effluent limits for nutrients.

Given the absence of effluent data, incremental control costs would be highly speculative and therefore we consider the following two scenarios:

- Scenario 1: effluent data indicate that the facility would not discharge nutrients above the proposed criteria, and
- Scenario 2: effluent data indicate that the facility would discharge nutrients above the proposed criteria.

Under Scenario 1, the facility would not have reasonable potential to exceed the proposed criteria and therefore would not need to implement incremental controls for compliance. There would be no costs under this scenario.

Under Scenario 2, the facility would have reasonable potential to exceed the proposed criteria and therefore would likely need to implement incremental controls for compliance. Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (101 million gallons requiring a pond size of almost 39 acres), existing effluent quality (may not be suitable for land application), and potential lack of available land may make no-discharge control options infeasible or unlikely. Thus, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 87% to less than 0.4 mg/L and TP by an additional 10% to 0.09 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 1.10 mgd (information on design flow is not available), total capital costs could be approximately $15.8 million. Based on an average flow of 0.792 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.101 million. Total annual costs would be $2.4 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 24 summarizes costs under both scenarios.

Exhibit 24: Potential Incremental Costs, Corette Thermal Plant

Treatment Control	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Scenario 1			

No Incremental Controls	$0	$0	$0
Scenario 2			
Biological and Chemical Treatment plus RO with MF	$15.8[2]	$0.101[3]	$2.4
1. Capital costs annualized at 7% over 10 years plus annual O&M. 2. Maximum flow (1.10 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF. 3. Average flow (0.792 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).			

4.8 Western Energy Company – Rosebud Mine

Western Energy Company (NPDES No. MT 0023965) is a surface coal producer that extracts sub-bituminous coal from the Rosebud Mine. To mine surface coal, a dragline excavator removes overburden prior to extraction of coal using a power shovel and truck. The mine produces approximately 8 million tons of sub-bituminous coal annually.

The primary wastewater discharge is storm water containing sediment from surface disturbances. The facility captures and treats this storm runoff with various sediment control facilities including ponds, traps, and alternate sediment control installations. According to the statement of basis (MTDEQ, 1999), 170 sediment control facilities are located around the perimeter of all active mine areas and some future mining areas. These sediment control facilities are located between all surface disturbances and downstream of all mining areas. Because storm runoff is the main wastewater component, the flow rates are variable through the facilities.

4.8.1 Summary of Effluent Data and Limits

There are no effluent TN and TP data available in EPA's ICIS-NPDES database for this discharger. There are no effluent limits for TN or TP in the permit.

4.8.2 Estimated Compliance and Costs

The facility does not have existing effluent limits or monitoring requirements for TN or TP. Given the lack of existing permit requirements and the nature of the wastewater (i.e. storm runoff), it is unlikely that the facility would have reasonable potential under the proposed rule. Thus, incremental compliance costs are likely zero.

4.9 Western Sugar Cooperative

Western Sugar Cooperative (NPDES No. MT 0000281) processes sugar beets to produce refined sugar and additional byproducts including beet pulp, molasses, pellets, calcium carbonate and slacked lime. The facility processes sugar beets seasonally during periods called campaigns, typically lasting from September through February or March (MTDEQ, 2009b). The facility reported an average sugar production of 1,692,343 lb/day for campaigns occurring from 2003 to 2006 (MTDEQ, 2009b).

Outfall 001 discharges effluent from a combination of barometric condenser process wastewater, seal tank discharges, and wastewater from the ash pond from the boiler flue gas scrubber and ash flume to the Yegen Drain. Outfall 001 discharges only during the campaign.

Outfall 002 discharges effluent from a combination of noncontact cooling water for turbines, carbon dioxide gas washer, and wastewater from the ash pond from the boiler flue gas scrubber and ash flume to the City of Billings storm water drain which discharges into the Yegen Drain. Outfall 002 discharges only during the campaign.

Outfall 004 discharges effluent from various unlined process and wastewater ponds located on the factory site via groundwater infiltration that is not hydraulically connected to the Yegen Drain or Yellowstone River. Thus, for this analysis, we did not consider Outfall 004.

4.9.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 1.1 mg/L and 0.12 mg/L, respectively, and are applicable only during the months of June through September. Exhibit 25 summarizes the nutrient data including TN and TP for these months. Because the facility only discharges during the campaign, effluent data during the proposed criteria months (June through September) are only available for September 2010.

Exhibit 25: Effluent Data Summary, Western Sugar Cooperative

Pollutant	Number of Observations	Average Effluent Concentrations (mg/L) [1]	Maximum Effluent Concentrations (mg/L) [1]	Effluent Limit (mg/L) [2]
		Outfall 001		
TKN	1	40.0	40.0	None
$NO_2 + NO_3$ as N	1	0.06	0.06	10.0
TN[3]	na	40.1	40.1	None
TP	1	0.55	0.55	None
		Outfall 002		
NH_3 as N	1	0.00	0.00	None
$NO_2 + NO_3$ as N	1	0.25	0.25	None
TN[4]	na	0.25	0.25	None
TP	1	0.36	0.36	None

na = not available
1. Effluent data represent average and maximum of maximum from September 2010 (EPA, 2011).
2. Represents the maximum daily limit. The average monthly limit for total ammonia as N is 2.80 mg/L.
3. TN represents the sum of TKN and $NO_2 + NO_3$ as N.
4. TN represents the sum of NH_3 as N and $NO_2 + NO_3$ as N.

4.9.2 Estimated Compliance and Costs

Outfalls 001 and 002 discharge to the Yegen Drain which is tributary to the Yellowstone River. The Yellowstone River (MT43F001_010) is on the state's 2010 303(d) list as impaired for nutrient/eutrophication biological indicators. The permit does not allow for a mixing zone for either outfall. Thus, we assume that no dilution would be available in the calculation of projected effluent limits for Outfall 001 and 002. The proposed criteria for TN and TP are 1.1 mg/L and 0.12 mg/L, respectively. The proposed criteria will be applicable only during the months of June through September. Exhibit 26 shows the reasonable potential analysis and projected effluent limits for TN and TP for Outfalls 001 and 002.

Exhibit 26: Reasonable Potential Analysis, Western Sugar Cooperative

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)[1]
		Outfall 001		
TN[2]	40.1	1.1	Yes	1.1

TP	0.55	0.12	Yes	0.12
Outfall 002				
TN[3]	0.25	1.1	No	1.1
TP	0.36	0.12	Yes	0.12
1. The projected effluent limit is equal to the proposed criterion. 2. TN represents the sum of TKN and NO_2 + NO_3 as N. 3. TN represents the sum of NH_3 as N and NO_2 + NO_3 as N.				

The exhibit indicates that the maximum TN and TP concentrations for Outfall 001 and that the maximum TN concentrations for Outfall 002 exceed the proposed criteria and that controls are likely necessary for compliance with projected effluent limits based on the proposed criteria.

For Outfall 001, the proposed criteria only apply for one month (September) during discharge. Thus, it is possible that no-discharge control options are available, including constructing a holding pond to prevent release during the criteria period. However, it is unclear whether the land available at the site could be used for a holding pond or if it is already designated for other purposes (e.g., beet crop or storage). Therefore, we consider the following two scenarios for Outfall 001:

- Scenario 1: the discharger would need to implement no-discharge controls.
- Scenario 2: the discharger would need to implement end-of-pipe treatment.

Under Scenario 1, we estimated potential compliance costs assuming that the discharger would need to construct a holding pond to prevent discharge during September. We estimated capital costs of approximately $12.5 million based on the unit cost in Exhibit 3, a maximum discharge of 4.02 mgd (information on design flow is not available), and a period of 30 days during the criteria period. Total annual costs would be $1.8 million based on annualizing capital costs at 7% over 10 years.

Under Scenario 2, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 63% to less than 1.1 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 4.02 mgd (information on design flow is not available), total capital costs could be approximately $57.8 million. Based on an average flow of 2.06 mgd and assuming operation of the treatment units for 30 days during the criteria period, annual O&M costs could be approximately $0.086 million. Total annual costs would be $8.3 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 27 shows the potential incremental costs for each Outfall 001 scenario.

Exhibit 27: Potential Incremental Costs for Outfall 001, Western Sugar Cooperative

Treatment Control	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Outfall 001			
Scenario 1: No-Discharge Control (Retention Pond)	$12.5[2]	$0[3]	$1.8

Scenario 2: End-of-Pipe Treatment (Biological and Chemical Treatment plus RO with MF)	$57.8[4]	$0.086[5]	$8.3
1. Capital costs annualized at 7% over 10 years plus annual O&M. 2. Based on maximum flow (4.02 mgd; design flow not available), holding period of 30 days, and unit costs in Exhibit 3. 3. O&M costs for no-discharge using a holding pond are expected to be negligible. 4. Maximum flow (4.02 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF. 5. Average flow (2.06 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (30 days).			

For Outfall 002, effluent data indicate that reductions are likely necessary for TP only. There have been no exceedances of the proposed criteria for TN during the applicable period. Due to the higher effluent flow (maximum of 5.34 mgd) and the uncertainty associated with the feasibility of a holding pond for Outfall 001, we assumed that end-of-pipe treatment controls would be the most feasible and cost-effective option for Outfall 002. Therefore, we estimated potential compliance costs assuming that the discharger would need to implement chemical treatment to reduce TP to less than 0.12 mg/L.

We estimated capital and O&M costs of approximately $0.72/gpd and $256/MG for chemical treatment based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 5.34 mgd (information on design flow is not available), total capital costs could be approximately $3.8 million. Based on an average flow of 2.79 mgd and assuming operation of the treatment units for 30 days during the criteria period, annual O&M costs could be approximately $0.021 million. Total annual costs would be $0.57 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 28 summarizes the total costs for Outfalls 001 and 002.

Exhibit 28: Potential Incremental Costs, Western Sugar Cooperative

Outfall	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Outfall 001	$12.4 – $57.8	$0 - $0.086	$1.8 - $8.3
Outfall 002	$3.8	$0.021	$0.57
Total	$16.4 - $61.6	$0.021 - 0.11	$2.4 - $8.9
1. Capital costs annualized at 7% over 10 years plus annual O&M.			

4.10 Fidelity – Tongue River Project WTF

The Tongue River Project Treatment Facility (also known as Fidelity Production and Exploration Company, Tongue River Symons Water Treatment Facility; NPDES No. MT 0030724) treats produced water from coalbed natural gas development. Six-hundred wells are located on the following plans of developments (PODs): CX Ranch with additions; Badger Hills POD, Coal Creek POD, and the Dry Creek POD.

The facility treats its produced water with Higgins Loop Ion Exchange technology to remove cations to reduce the salinity and sodium adsorption ratio (MTDEQ, 2010c). The ion exchange substitutes cations with hydronium ions from strong acid cation resin, lowering the pH of the water to about 2.0 – 3.0

standard units. The facility then degasses and discharges treated water to a neutralizing bed containing limestone to raise the pH to the desired level. Due to the effectiveness of the cation removal, the facility mixes a portion of the raw produced water with the treated water prior to discharge to buffer pH towards a desired level and reduce operating costs.

The facility regenerates the strong acid cation resin by rinsing with hydrochloric acid, resulting in a small portion of brine. It neutralizes the brine and transports it to a Class II injection well in Wyoming or further concentrates the brine and disposes of it in a solid waste landfill.

The facility discharges treated water to the Tongue River primarily through Outfall 001, though Outfalls 013 and 016 may also be used as alternative discharge points. EPA's ICIS-NPDES database has no record of effluent data from Outfall 013 and only one record of effluent data from Outfall 016 (March 2010), which did not occur during the proposed criteria months (June through September). Because the Outfalls 013 and 016 are not active during the proposed criteria months and they discharge effluent from the same treatment train as Outfall 001, we exclude Outfalls 013 and 016 from this analysis. The facility has a separate permit (MT0030457) to discharge wastewater in excess of the 1700 gpm (2.44 mgd) permit limit.

4.10.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 1.1 mg/L and 0.12 mg/L, respectively, and are applicable only during the months of June through September. Exhibit 29 summarizes the nutrient data including TN and TP for these months.

Exhibit 29: Effluent Data Summary, Fidelity – Tongue River Project WTF

Pollutant	Number of Observations	Average Effluent Concentration (mg/L)[1]	Maximum Effluent Concentration (mg/L)[1]	Effluent Limit (mg/L)
Outfall 001				
TN	12	0.37	0.60	[2]
TP	12	0.07	0.10	None

1. Effluent data from 2008 through 2010 from the months of June through September representing average and maximum of maximum monthly values. (EPA, 2011)
2. Permit levels vary by season. For November through February, the TN average monthly limit is 1.2 mg/L and the TN maximum daily limit is 1.7 mg/L. For March through June, the TN average monthly limit is 1.3 mg/L and the TN maximum daily limit is 1.8 mg/L. For July through October, the TN average monthly limit is 1.1 mg/L and the TN maximum daily limit is 1.6 mg/L.

4.10.2 Estimated Compliance and Costs

This facility discharges into the Tongue River (MT42B001_010), which is not on the state's 2010 303(d) list as impaired for nutrients. Because the permit describes a mixing zone for ammonia, but not for TN, it is unclear if the facility would likely receive a mixing zone and therefore we consider the following two scenarios:

- Scenario 1: the discharger receives a mixing zone, and
- Scenario 2: the discharger does not receive a mixing zone.

Exhibit 30 shows the reasonable potential analysis and projected effluent limits for TN and TP under both scenarios.

Exhibit 30: Effluent Limit and Reasonable Potential Analysis, Fidelity Tongue River Project WTF Under Scenario 1 (Mixing Zone Granted)

Pollutant	Outfall Data		Receiving Water Data			Calculations	
	Maximum Effluent Concentration (mg/L)	Design Flow (mgd)	Ambient Concen-tration (mg/L)	14Q10 (mgd)	Proposed Criterion (mg/L)	Concentration at Edge of Mixing Zone (mg/L)[1]	Reasonable Potential[2]
Scenario 1: Mixing Zone Allowed							
TN	0.60	2.44	0.39	26	1.1	0.41	No
TP	0.10	2.44	0.052	26	0.12	0.056	No
Scenario 2: No Mixing Zone							
TN	0.60	na	na	na	1.1	0.60[3]	No
TP	0.10	na	na	na	0.12	0.105[3]	No

na = not applicable
1. Calculated using mixing equation, ambient TN concentration, and assumption that 100% of 14Q10 is available for dilution using and 14Q10.
2. Reasonable potential exists if concentration at edge of mixing zone exceeds proposed criterion.
3. Represents maximum effluent concentration because no mixing zone is available.

The exhibit indicates that under both scenarios, the facility would not have reasonable potential and would not be likely receive an effluent limit for TN or TP. Therefore, the discharger is not likely to incur incremental costs.

4.11 Stillwater Mining Company

Stillwater Mining Company (NPDES No. MT 0024716) operates an underground platinum and palladium mine. Production is approximately 2,000 tons per day (MTDEQ, 2010a). The facility mills ore-bearing rock at a concentrator using a froth-floatation process and uses tailings as underground backfill or stores them in one of two lined tailings impoundments. Because discharge of mill water is not permitted, the facility sends it to a tailing impoundment.

Wastewater produced from underground mining collects in the main sumps on the east and west sides of the mine. Sources of pollutants in the wastewater come from blasting agent residuals, decant water from slurried backfill, and mine drainage off haulage ways, old workings, and stockpiled rock.

The mine has two major wastewater bearing adits, one on the east side of the Stillwater River (East Side Adit) and one on the west (West Side Adit). Wastewater from the East Side Adit receives settling through primary clarification. Wastewater form the West Side Adit receives both primary clarification and biological treatment. The combined effluent discharge from the two adits is expected to be 0.942 mgd (MTDEQ, 2010).

The facility has two outfalls that discharge to groundwater:

- Outfall 002: Infiltration of 0.41 mgd (based on maximum observed flow rate) to groundwater from a series of four percolations ponds located east of the Stillwater River (Class I groundwater).
- Outfall 003: Infiltration of 0.88 mgd (based on maximum observed flow rate) to groundwater from a series of four percolations ponds located east of the Stillwater River (Class I groundwater).

The permit and statement of basis also describe Outfall 001, which when constructed will discharge directly to the Tongue River. However, data from EPA's ICIS-NPDES database suggest that the outfall is not yet operational. Since variances are typically not applicable to new discharges, we did not evaluate this outfall.

4.11.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 0.3 mg/L and 0.03 mg/L, respectively, and are applicable only during the months of June through September. Exhibit 31 summarizes the nutrient data including TN and TP for these months.

Exhibit 31: Effluent Data Summary, Stillwater Mining Company

Pollutant	Number of Observations	Average Effluent Concentration (mg/L) [1]	Maximum Effluent Concentration (mg/L) [1]	Effluent Limit (mg/L)
Outfall 002				
TKN	6	0.50	0.50	None
$NO_2 + NO_3$ as N	6	0.22	0.50	None
TN[2]	na	0.72	1.0	[3]
TP	6	0.013	0.027	None
Outfall 003				
TKN	6	1.6	3.6	None
$NO_2 + NO_3$ as N	6	4.5	17.6	None
TN[2]	na	5.4	21.2	[3]
TP	6	0.12	0.40	None

na = not available
1. Effluent data from 2009 through 2010 from the months of June through September representing average and maximum of maximum monthly values. (EPA, 2011)
2. TN represents the sum of TKN and $NO_2 + NO_3$ as N.
3. Permit levels vary by season. For November through February, the TN average monthly limit is 1.2 mg/L and the TN maximum daily limit is 1.7 mg/L. For March through June, the TN average monthly limit is 1.3 mg/L and the TN maximum daily limit is 1.8 mg/L. For July through October, the TN average monthly limit is 1.1 mg/L and the TN maximum daily limit is 1.6 mg/L.

4.11.2 Estimated Compliance and Costs

Outfalls 002 and 003 discharge to Class I groundwater which parallels the Stillwater River before a bedrock constriction directs groundwater discharge to the river (MTDEQ, 2010a). The existing permit allows for mixing zones for TN for Outfalls 002 and 003 based on testing at downgradient monitoring wells at the edge of each mixing zone. However, there are no data from which to determine how much of the TN seeping in from the groundwater at the edge of each mixing zone is from the mine discharge and how much nitrogen is already present in the groundwater. Thus, due to a lack of data, we conservatively assumed that the facility would not receive a mixing zone.

Exhibit 32 shows the reasonable potential analysis and projected effluent limits for TN and TP for Outfalls 001 and 002.

Exhibit 32: Reasonable Potential Analysis, Fidelity – Stillwater Mining Company

Pollutant	Maximum Effluent Concentration (mg/L)	Proposed Criterion (mg/L)	Reasonable Potential	Projected Effluent Limit (mg/L)
Outfall 002				
TN[1]	1.0	0.3	Yes	0.3[2]

TP	0.027	0.03	No	None
Outfall 003				
TN[1]	21.2	0.3	Yes	0.3[2]
TP	0.40	0.03	Yes	0.03[2]
1. TN represents the sum of TKN and NO_2 + NO_3 as N. 2. The projected effluent limited is equal to the proposed criterion.				

Based on the maximum effluent concentrations, the facility has reasonable potential for TN for Outfall 002 and reasonable potential for TN and TP for Outfall 003, and would therefore likely receive revised effluent limits for both pollutants. Effluent data for Outfall 002 indicate that the facility may not be in compliance with projected TN effluent limits based on the proposed criteria, and reductions may be necessary. For Outfall 003, effluent data also indicate that reductions in TN and TP may be needed for compliance with projected effluent limits based on the proposed criteria.

The facility already utilizes a number of holding/percolation ponds, and even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (119 million gallons requiring a pond size of over 45 acres) and potential lack of available land may make no-discharge control options infeasible or unlikely. Thus, we estimated potential compliance costs assuming that the discharger would need to implement end-of-pipe treatment.

For Outfall 002, we estimated that the discharger would need to implement RO with MF to reduce TN from the current maximum (1.0 mg/L) by an additional 70% to less than 0.3 mg/L. We estimated capital and O&M costs of approximately $13.00/gpd for MF and RO $980/MG for MF and RO based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 0.41 mgd (information on design flow is not available), total capital costs could be approximately $5.4 million. Based on an average flow of 0.34 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.031 million. Total annual costs would be $0.79 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

For Outfall 003, we estimated that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 90% to less than 0.3 mg/L and TP by an additional 70% to less than 0.03 mg/L. We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 0.88 mgd (information on design flow is not available), total capital costs could be approximately $12.6 million. Based on an average flow of 0.27 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.034 million. Total annual costs would be $1.8 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 33 summarizes these costs.

Exhibit 33: Potential Incremental Costs, Stillwater Mining Company

Treatment Control	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Outfall 002: RO with MF	$5.4[2]	$0.031[3]	$0.79
Outfall 003: Biological and Chemical			

Treatment plus RO with MF			
Total	$18.0	$0.065	$2.6
1. Capital costs annualized at 7% over 10 years plus annual O&M. 2. Maximum flow (0.412 mgd; design flow not available) multiplied by unit cost of $13.00/gpd for RO with MF. 3. Average flow (0.339 mgd) multiplied by unit cost of $980/MG for RO with MF and the number of operating days per year (92 days). 4. Maximum flow (0.877 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF. 5. Average flow (0.266 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).			

4.12 Montana-Dakota Utilities Company, Lewis and Clark Station

The Montana-Dakota Utilities Company, Lewis and Cark Station (NPDES No. MT 0000302) is a coal fired steam electric generating plant. The facility contains four outfalls, all of which discharge to the Yellowstone River.

- Outfalls 002 and 004 discharges once-through cooling water. Outfall 002 discharges only during cold weather (upstream of the water intake to prevent icing problems) and Outfall 004 discharges during the remainder of the year.
- Outfall 003 discharges river silt and debris removed by primary settling and screening at the intake structure and sand sump pump. Since this discharge has no contact with the facility beside clearing solid debris, it is not expected that this discharge will have nutrient concentrations above the ambient concentration of the source water.
- Outfall 007 discharges ash sluice water, evaporator and boiler blowdown, floor drains, water treating sludge filter and softener rise, metal cleaning wastes and storm water.

4.12.1 Summary of Effluent Data and Limits

The proposed criteria for TN and TP are 1.2 mg/L and 0.14 mg/L, respectively, and are applicable only during the months of August through October. There are no effluent TN and TP data available in EPA's ICIS-NPDES database for this discharger. There are no effluent limits for TN or TP in the permit.

4.12.2 Estimated Compliance and Costs

The facility does not have existing effluent limits or monitoring requirements for TN or TP. The facility discharges once-through cooling water through Outfalls 002 and 004. U.S. EPA (2009) indicates that once-through cooling water and cooling tower blowdown may contain the following pollutants, often in low concentrations, as a result of chlorination and corrosion and erosion of the piping, condenser, and cooling tower materials: chlorine, iron, copper, nickel, aluminum, boron, chlorinated organic compounds, suspended solids, brominated compounds, and nonoxidizing biocides. Thus, given the lack of existing permit requirements and the nature of the wastewater (e.g., once-through cooling water), it is unlikely that the facility would have reasonable potential to exceed the proposed criteria for nutrients. Thus, incremental compliance costs are likely zero.

For Outfall 007 (maximum flow of 1.1 mgd), it is uncertain whether discharge of bottom ash handling system and miscellaneous wastes would contain nutrients. Given the absence of effluent data, incremental control costs would be highly speculative and therefore we consider the following two scenarios:

- Scenario 1: effluent data indicate that the facility would not discharge nutrients above the proposed criteria, and
- Scenario 2: effluent data indicate that the facility would discharge nutrients above the proposed criteria.

Under Scenario 1, the facility would not have reasonable potential to exceed the proposed criteria and therefore would not need to implement incremental controls for compliance. There would be no costs under this scenario.

Under Scenario 2, the facility would have reasonable potential to exceed the proposed criteria and therefore would likely need to implement incremental controls for compliance. Even though the criteria only apply for 3 months of the year, the relatively large volume of wastewater needing storage (101 million gallons requiring a pond size of almost 39 acres) and potential lack of available land may make no-discharge control options infeasible or unlikely. Therefore, we estimated potential compliance costs assuming that the discharger would need to implement biological and chemical treatment to reduce TN and TP to less than 3 mg/L and 0.1 mg/L, respectively, and then add RO with MF to reduce TN by an additional 60% to less than 1.2 mg/L.

We estimated capital and O&M costs of approximately $14.37/gpd ($1.37/gpd for biological and chemical treatment plus $13.00/gpd for MF and RO) and $1,385/MG ($405/MG for biological and chemical treatment plus $980/MG for MF and RO) based on the unit costs shown in Exhibit 4 and Exhibit 5. Based on a maximum discharge of 1.1 mgd (information on design flow is not available), total capital costs could be approximately $15.1 million. Based on an average flow of 0.83 mgd and assuming operation of the treatment units for 92 days during the criteria period, annual O&M costs could be approximately $0.11 million. Total annual costs would be $2.3 million based on annualizing capital costs at 7% over 10 years plus annual O&M.

Exhibit 34 summarizes costs under both scenarios.

Exhibit 34: Potential Incremental Costs, Montana-Dakota Utilities Company, Lewis and Clark Station

Treatment Control	Capital Costs ($ million)	O&M Cost ($ million/year)	Annual Costs ($ million/year)[1]
Scenario 1			
No Incremental Controls	$0	$0	$0
Scenario 2			
Biological and Chemical Treatment plus RO with MF	$15.8[2]	$0.11[3]	$2.3

1. Capital costs annualized at 7% over 10 years plus annual O&M.
2. Maximum flow (1.1 mgd; design flow not available) multiplied by unit cost of $14.37/gpd for biological and chemical treatment plus RO with MF.
3. Average flow (0.83 mgd) multiplied by unit cost of $1,385/MG for biological and chemical treatment plus RO with MF and the number of operating days per year (92 days).

4.13 Uncertainties of the Analyses

There are a number of uncertainties associated with the analysis of potential incremental costs of implementing the revised numeric nutrient criteria. For example, data limitations result in uncertainty regarding available dilution and mixing zones for several dischargers. In most cases, we estimated a range of potential costs. However, if data indicate that a mixing zone is available costs could be much lower than estimated.

Also, the feasibility of various no-discharge options is uncertain for most of the dischargers. Reuse options, deep well injection, or land application/spray fields would be much less expensive to implement, where feasible, than end-of-pipe treatment such as BNR and RO. Given the seasonality of the criteria, no-discharge control options could be feasible and cost-effective for a number of dischargers, thus, greatly reducing potential compliance costs.

Costs may also be overestimated for those dischargers in which we used other data regarding the potential to discharge nutrients to determine RP. If actual effluent monitoring data indicate no RP, incremental control costs could be zero.

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